ANNUAL REPORT

OF

THE SUDAN VETERINARY SERVICE

1931.

CONTENTS.

-o*o-

* * *

Sadik.

STAFF.

The following staff changes took place during the year :-

Mr. W.Gray, M.R.C.V.S., was transferred from Kassala Province to the Blue Nile Province on 5th March, 1931.

Mr.T.W.Stobo, M.R.C.V.S., was transferred from Halfa Province to Darfur Province on 21st March, 1931.

Mr.A.B.MacIntyre, M.R.C.V.S., retired from the Service with effect from 18-11-1931.

The Sudan Veterinary Service assumed veterinary charge of the animals of the Sudan Defence Force on January 1st and five Officers of the Royal Army Veterinary Corps, who had been seconded for this duty, returned to the Corps early in the year.

Owing to financial stringency it was decided to reduce the establishment of Veterinary Inspectors from fifteen to twelve.

The distribution of the Veterinary Staff on 31st. December, 1931 was as follows :-

NAME	Designation	Station
Mr. W. Kennedy, D.S.O.	Director	Khartoum
Capt. R.S. Audas, M.C., 3N.	Asst/Director	* Darfur
Mr. S.C.J.Bennett, B.Sc.	Veterinary Research Officer	Khartoum
Mr.J.T.R. Evans, B.Sc.	Asst/Veterinary Research Officer	Malakal
Capt.J.Going, 4N.	Veterinary Inspector	Kassala
Capt.C.P.Fisher	" "	El Dueim
Major J.R. Ellison	" "	Khartoum
Capt. T.Menzies, D.V.S.M.(Vict)	" "	El Fasher
Capt. H.B. Williams, O.B.E.	" "	El Obeid.
Capt. L.E. Pritchard, O.B.E.	" "	Wad Medani
Mr. C.W. Pembrey.	" "	Singa
Mr. W.H. Glanville	" "	Malakal.
Mr. J.E. Furney	" "	Shendi.
Mr. J.A. Gillespie	" "	El Obeid
Mr. W. Gray	" "	Wad Medani
Mr. T.W. Stobo	" "	El Fasher.

* On temporary duty.

VETERINARY POLICE

Steps were taken early in the year, on grounds of economy, to reduce the Veterinary Police Force by 33⅓ per cent and it is intended to effect further reductions in 1932 with a view of the ultimate abolition of the Force. It is hoped that it will be found possible by that time to train a sufficient number of tribal retainers to carry out many of the duties which have devolved on the Veterinary Police in the past, and to provide a certain number of Native Stock Inspectors to supervise the work of those retainers. Some of the duties carried out by the Veterinary Police Force will, however, require to be performed by the Province Police Forces in future.

TRIBAL VETERINARY ORGANIZATIONS.

As stated in last year's report, a commencement was made to build up tribal veterinary organizations by training tribal retainers in such veterinary work as would make them useful to their tribes in the control of diseases of livestock. Further progress in this direction was made during the period under review and the results obtained are very encouraging. It was unfortunate in many ways that the inauguration of this scheme coincided with one of the most serious invasions of cattle plague which the country has experienced in recent years. This occurrence did not give the newly recruited staffs a fair chance to prove their true value as they were called upon to function while still partly trained and in insufficient numbers to cope with the task they were faced with. The experience of the past twelve months, however, should emphasise the necessity of providing adequate staffs of tribal veterinary retainers throughout the cattle-breeding areas of the country and, if this necessity is fully recognised, good may come out of evil.

SECTION I.

DISEASES OF ANIMALS.

1. DISEASES OF CATTLE.

Cattle Plague.

At the end of last year the position in regard to cattle plague was far from satisfactory. The disease was prevalent throughout the cattle-breeding areas of the country and the outbreaks were so numerous and so widespread that, in many cases, the veterinary staff was quite unable to cope with them. As the dry season advanced the control of the disease became even more difficult and, in several areas, lack of grazing led to heavy losses from starvation. The congregation of large herds of cattle on permanent water supplies provided conditions highly favourable to the rapid spread of the disease, and the isolation of infected herds was frequently found to be impracticable. To add to these difficulties the small stock of cattle plague anti-serum left over from last year was exhausted before fresh supplies could be made available and, when these were forthcoming, they proved quite inadequate to meet the demand. Generally speaking this unsatisfactory state of affairs persisted, with disastrous results to the cattle-owning tribes, until the onset of the rains. An immediate improvement was registered when the herds moved to their northern grazing grounds after the rains and, by the end of the year, all existing outbreaks had been brought under effective control.

Reviewing the situation it is obvious that the lack of veterinary staff to detect outbreaks in the early stages and to adopt measures promptly to prevent the further spread of the disease to neighbouring herds accounted for the disease getting out of control in the first instance. Outbreaks occurred later in circumstances in which it was impossible to limit the disease to the originally infected herds and, in such cases, the lack of reserve supplies of cattle plague anti-serum resulted in heavy losses occurring which otherwise might have been avoided.

As already mentioned the stock of serum left over from last year gave out before fresh supplies could be made available and, although some 73,000 doses (as against 60,000 doses originally aimed at) were produced at the serum station in the first six months of the year, the supply did not permit, at any time during that period, of any reserves being held. The difficulties experienced in producing the quantity of serum mentioned were very considerable and are outlined in the attached report of the Veterinary Research Officer. Owing to the adverse conditions under which the serum was produced, coupled with the fact that no opportunity occurred of mixing the various "brews" in order to obtain a serum of standard potency, the quality of serum obtained towards the close of the season deteriorated somewhat, but, in all the circumstances, the results obtained reflected great credit on the staff of the serum station.

With a view of providing an additional weapon for use in combating cattle plague the Veterinary Research Officer carried out certain investigations the object of which was to produce a vaccine with keeping qualities superior to those of the cattle plague vaccines receiving attention in other countries. Unfortunately the extreme urgency of the situation in regard to the disease made it necessary to use this vaccine as soon as it was prepared and, while the antigenic value of the vaccine in the fresh state was proved beyond doubt, no other useful information was obtainable.

The total number of deaths recorded from cattle plague during the year was 16,812 as compared with 15,425 last year. The records available, however, are far from complete since the Rizeigat tribe alone in Southern Darfur are estimated to have lost 20,000 head during the recent epizootic and the total losses suffered in the Upper Nile Province are estimated to have been in the neighbourhood of 100,000 head. The results obtained at the Serum Station during recent years with cattle of all ages and from all parts of the Upper Nile Province showed that all the cattle drawn from the area West of the Nile were susceptible to cattle plague, and from this it was deduced that that area had been free of the disease for a period of at least ten years. This was borne out by the losses recorded in uncontrolled outbreaks, when the disease became widespread during the past eighteen months, as the mortality sometimes exceeded 80%. As a result of exceptionally light rains in the Upper Nile Province last year the grazing and watering conditions were such as to favour the rapid spread of the disease and the movements of infected game in search of grass and water were thought to have further accelerated the spread of infection.

Infected game, particularly buffalo, were reported to have played an important part in spreading the disease in Mongalla Province and in Rumbek District, Bahr el Ghazal Province.

When last year's report was written it was thought that the outbreaks which had occurred in Dongola Province were then under effective control. Unfortunately recrudescences of the disease occurred during the first half of the year and 1,170 deaths were registered before the infection was finally stamped out.

The consolidated returns of outbreaks of cattle plague for the past three years are given below but, as previously stated, these are far from complete :-

Year	No. of Outbreaks	No. of Cattle involved	No. of deaths
1929	795	124,406	12,743
1930	981	180,540	15,425
1931	882	177,745	16,812

These returns refer only to outbreaks which came under the supervision of the Veterinary Police Force and they are much less complete for 1931 than for the two previous years owing to the reduction of the Veterinary Police establishment by one third during the year.

In dealing with the various outbreaks, cattle plague anti-serum was administered to 66,000 head, and 5,248 cattle were vaccinated against the disease.

The Sudan is continually menaced by invasions of cattle plague from neighbouring territories and it is considered doubtful if our most Southern Provinces are ever free of the disease. The wave of cattle plague which recently swept over the country has left the majority of the surviving cattle immune to further attacks of the disease and, while a new generation of susceptible cattle is being produced, full advantage should be taken of the breathing space provided in order to strengthen the veterinary defences of the country in preparation for the next invasion. This could best be done by the provision of a sufficient number of suitably trained Veterinary Tribal Retainers in the threatened areas and by the provision of adequate supplies of serum at strategic points in the cattle-breeding districts. It is hoped that it will be found possible to take action along the lines indicated in the near future.

Contagious Bovine Pleuro-Pneumonia.

Small outbreaks of contagious bovine pleuro-pneumonia occurred in White Nile, Khartoum and Blue Nile Provinces and were easily suppressed but in Darfur, Kordofan and Kassala Provinces, and in the Bor District of Upper Nile Province, this disease assumed more serious proportions than it did last year. This was largely attributable to the shortage of grazing and water that occurred in many areas during the first half of the year and the consequent congregation of large numbers of cattle at certain points which provided conditions favouring the spread of contagious bovine pleuro-pneumonia as well as of cattle plague.

The number of outbreaks dealt with in Kordofan, Kassala and Darfur Provinces was ninety-two as compared with fifty-seven in the previous year, while the total number of deaths recorded from the disease was 1,382 as compared with 494 in 1930 and 1,340 in 1929. The position in Kordofan showed a marked improvement towards the end of the year.

To meet the requirements of the Veterinary Staff in dealing with the various outbreaks, and in conferring immunity on cattle occupying areas threatened by the disease, 23,580 doses of vaccine were issued from the Veterinary Laboratory during the year. This quantity of vaccine represents an increase of 50 per cent on last year's demand.

Twenty-seven cases of contagious bovine pleuro-pneumonia came under notice among cattle awaiting export to Egypt during the year, as compared with forty-eight cases last year.

Anthrax.

An outbreak of anthrax occurred in Dar-el-Ahamda, White Nile Province, but it was not reported until it was all over. Three people and seventy head of cattle were reported to have died of the disease. The infection was finally got rid of by moving the village to clean ground.

Of the various diseases of cattle prevalent in the country, other than those already mentioned, none assumed such proportions during the year as to call for special notice.

II. DISEASES OF CAMELS.

The total losses among camels for which forage allowance was drawn amounted to three hundred and fourteen this year as compared with three hundred and ninety-four last year and four hundred and sixty in 1929. These figures include animals which were cast as old, worn out and unfit for further service, amounting this year to a quarter of the total. The method of diagnosis and the treatment of trypanosomiasis of camels have been so simplified that losses from this cause among Police and Army camels are now so small as to be almost negligible. The results of a series of observations conducted by the field staff during the year under the direction of the Veterinary Research Officer enabled the latter to modify somewhat the technique of applying the mercuric chloride test for trypanosomiasis and to reduce the routine dose of Naganol from ten grammes to four grammes. Details of these observations are given in the report of the Veterinary Research Officer and do not call for further comment here.

Outbreaks of mange occurred among Police and Army camels during the year and, although little difficulty was experienced in keeping this disease under control, it appears to be almost impossible to prevent reinfection from native-owned camels which spread infection along the trade routes.

A case of anthrax occurred in a camel in Kassala Province in June and several persons who handled or ate the flesh contracted the disease.

III. DISEASES OF EQUINES.

African Horse Sickness.

The mortality from African Horse-Sickness during the period under review, although heavier than that recorded last year, was not abnormal. Thirteendeaths occurred in the irrigated area, Blue Nile Province, including a number of valuable horses. Of the horse-owning tribes the Messeria was the only one which reported heavier losses than usual. The returns of the casualties caused by this disease among the horses and mules in Government service during the last four years are as follows :-

YEAR	HORSES	MULES	TOTAL
1928	24	16	40
1929	27	44	71
1930	14	11	25
1931	13	29	42

Epizootic Lymphangitis.

This disease was definitely diagnosed at the Veterinary Research Laboratory from material forwarded from thirty-six horses, forty-one mules and four donkeys during the year. Fifty of these cases occurred among Police horses and mules in the Upper Nile Province, eleven cases occurred in the Fung Province and ten cases in Kordofan Province. The position in regard to this disease in the Fung Province has improved considerably, but in the Upper Nile Province the absence of facilities for the isolation of suspected cases has considerably handicapped the Veterinary Inspector in his efforts to control the disease. The cases reported from Kordofan Province all occurred in the Nuba Mountains Districts.

Trypanosomiasis.

A few cases of T.brucei and T.congolense infection came under notice in horses, mules and donkeys during the year.

IV. DISEASES OF SHEEP & GOATS.

With the exception of a few outbreaks of contagious caprine pleuro-pneumonia, no notable mortality from infectious or contagious diseases occurred during the year among sheep or goats. A few sheep were reported to have died on the Gezira Research Farm from the disease known as "heart-water" but the outbreak was controlled by periodical dipping.

V. DISEASES OF DOGS.

Rabies was definitely diagnosed in dogs at the Wellcome Tropical Research Laboratories from material forwarded for examination from the following Provinces :-

Blue Nile.....	2 cases in January, 1 in March, 3 in July, 1 in August and 1 in November.
Kordofan......	1 case in June and 1 case in July.
Mongalla......	1 case in August.
Kassala.......	1 case in November.
Darfur........	1 case in January.
Khartoum......	1 case in March & 1 case in June.

In addition to the above the disease was definitely diagnosed in dogs from material forwarded from Port Sudan : 1 case in September and 1 case in November, and from Suakin: 1 case in October.

It was not always possible to obtain material for diagnosis from animals suspected of being rabid and many cases were not reported until after the outbreaks had died out. Nine camels and one donkey were reported to have died of the disease in the Butana in April; one donkey died at El Obeid in August; one camel died in Darfur and one donkey in the Blue Nile Province in December.

During the year 22,446 ownerless or stray dogs were destroyed in the Blue Nile Province and, in all other infected and threatened areas, every effort was made to reduce the number of dogs to a minimum.

SECTION II.

TRADE IN LIVESTOCK AND LIVESTOCK PRODUCTS

I. EXPORT AND IMPORT TRADE.

The abnormally low prices which primary commodities are fetching on the world's markets and the resultant trade depression have seriously affected Egypt's capacity to import meat, and the decline registered last year in our exports of cattle and sheep became more marked this year.

Although the average prices paid in El Obeid market for cattle intended for export were 27 per cent below last year's prices the cattle merchants experienced the greatest difficulty in marketing, at any profit, the consignments they forwarded to the Egyptian markets. It is not surprising, therefore, to find that our exports of cattle and sheep declined by 4,178 head and 4,844 head respectively. Local supplies of cattle and sheep were well maintained during the trading season and no outbreaks of disease occurred in the quarantine stations to interfere with the trade.

An enterprising Greek merchant exported two hundred head of cattle from Wau, Bahr el Ghazal Province, to Doruma in the Belgian Congo during the year. The road from Wau to Doruma traverses an extensive tsetse fly belt so the owner administered atoxyl and tartar emetic to the cattle in an endeavour to protect them against infection en route. More recently motor transport has been used to convey the cattle to their destination.

Further details of the trade in cattle and sheep are given in the following tabulated statements :-

A. Numbers and values of cattle and sheep exported during the last four years.

YEAR	Cattle	Sheep	Valuation at Port of export
1928	11,114	13,961	LE. 75,732
1929	10,412	15,079	" 84,045
1930	9,520	5,702	" 60,041
1931	5,347	919	" 23,245

B. Numbers of cattle imported during the last four years.

Year	French Equatorial Africa	Eritrea	Abyssinia	Total
1928	1,029	127	1,511	2,667
1929	2,834	290	1,743	4,867
1930	3,170	8	1,605	4,783
1931	65	16	839	920

C. Origin of cattle exported during the last three years.

Province	1929	1930	1931
Darfur & Kordofan	7,764	6,465	4,624
White Nile	784	355	88
Upper Nile.......	847	453	299
Bahr el Ghazal...	-	305	230
Khartoum.........	122	302	101
Berber...........	895	1,640	-
Red Sea..........	-	-	5
TOTALS......	10,412	9,520	5,347

D. Average market prices and total numbers of cattle sold for export in El Obeid market during the last four years.

Year	No. of Cattle sold	Average price LE.Mms
1928	7,034	3.338
1929	7,675	3.355
1930	5,780	3.033
1931	2,126	2.210

Camels.

Six hundred and forty camels were exported from Kassala Province to Egypt in February but no further movement occurred between February and October. In October trade prospects were not good but the demand in Egypt improved in November and it is considered that, ultimately, more camels were exported than in the previous trading season. Permits for the export of the following numbers of camels were issued in the Provinces shown during the year :-

Kassala Province	.....	8,528 head
Khartoum Province	.....	1,035 "

The prices offered locally were poor and ranged from LE.1.500 to LE.3.500 per head.

There was practically no export trade in camels to French Equatorial Africa this year owing to an import tax of 200 francs per head having been imposed by the French Authorities.

Mules.

One hundred and twenty-nine mules were imported from Abyssinia during the year, while the imports in 1929 and 1930 were three hundred and eighty-five and fifty-three respectively.

Hides and Skins.

The following tabulated statement, compiled from the Customs Returns, shows the exports of hides and skins, and the values of same, for the last five years :-

Year	Hides	Skins	Total value
	Tons	Tons	L. E.
1927	1,067	932	155,285
1928	2,309	880	298,623
1929	1,328	1,013	185,898
1930	1,049	950	138,854
1931	818	900	78,069

As mentioned in last year's report the price of hides in Omdurman market slumped from LE.40 per ton to LE.25 per ton in the course of the year. The demand from abroad was fairly well maintained during the first four months of this year and prices remained steady around LE.25 per ton. From May until September there was little or no demand and the price fell to about LE.13 per ton. Some improvement took place in October and November, however, and when the year closed the average price was in the neighbourhood of LE.17 per ton. In the circumstances the quantity of hides exported this year must be regarded as very satisfactory for, when the price of hides slumped in 1921, the quantity exported that year was only 39 tons as compared with 758 tons in the previous year.

Exports of hides to Great Britain amounted to three hundred and nine tons while the quantities exported to Turkey, Syria and Italy were one hundred and sixty-two, one hundred and thirty-eight and one hundred and seven tons respectively.

The average prices offered locally for sheep skins during the year were P.12 for selected slaughter house skins and P.9 for other qualities. These prices represent falls of 43 per cent and 34 per cent respectively on last year's prices. As compared with last year the fall in value of goat skins was approximately 50 per cent.

The following information in regard to the classification of 93,563 hides exported during the year has been kindly supplied by the merchants who handled the consignments :-

Classification of hides		Number of hides.
Fasher flint-dried	....	9,915
Fashoda	....	75,236
Dry salted........	....	2,732
Air salted........	....	5,680

Samn or Maslee (Clarified Butter).

The exports and imports of samn, according to the Customs Returns, for the last three years were as follows:-

	1929		1930		1931	
	Tons	Value	Tons	Value	Tons	Value
		L.E.		L. E.		L. E.
Exports	261	22,493	284	22,316	244½	16,614
Imports	24	1,941	25	1,858	28	1,865

One hundred and sixty-two tons of samn, valued at LE.8,910, were despatched during the year by rail or steamer from White Nile Province to various local markets and three hundred and ninety-two tons were railed from El Obeid, Kordofan Province.

II. INTERNAL TRADE

Meat Supplies.

The numbers of animals slaughtered for food in ten of the larger towns during the past three years were as follows :-

	1929	1930	1931
Cattle	22,599	22,230	17,927
Sheep	166,362	159,330	156,303
Goats	13,230	10,956	7,395
Camels	2,467	2,756	2,408

The returns of animals slaughtered in the c various markets in Blue Nile Province for the past three years were as follows :-

Year	Cattle	Camels	Sheep	Goats
1929	9,580	4,080	68,900	9,870
1930	5,660	2,150	45,680	1,850
1931	5,517	1,895	49,441	2,713

The demand for cattle and sheep for slaughter was poor throughout the year and prices dropped to an exceptionally low level.

SECTION III.

IMPROVEMENT OF LIVESTOCK.

Cattle.

During the past four years nine young half-bred Friesian bulls were despatched to Upper Nile Province in order to ascertain whether such cattle would thrive or not when kept under natural conditions in that area. The results have been uniformly unsatisfactory and no good purpose would appear to be served by continuing this experiment.

Many of the Tribal Veterinary Retainers in Kordofan and Darfur Provinces have now been taught to use a "bloodless" castrating instrument and, by this means, it has been possible to sterilise a large number of young bulls considered to be unsuitable to breed from. It is considered that a permanent improvement of the native breed of cattle will be obtained in a more satisfactory manner by the elimination of "scrub" bulls in this way than by any other means at our disposal.

Horses.

The Assistant Director of Veterinary Services, Captain R.S.Audas, M.C., 3N., reports as follows on the progress made with the horse-breeding scheme during the year:-

> "I am pleased to be able to report that in spite of the fact that the three horse-breeding centres have suffered generally and have, from the livestock point of view, gone through one of the worst years on record - the combined ravages of locusts, birds and cattle plague with the resulting absence of forage, grazing and milk, being the chief factors - that results, though disappointing in certain districts, were generally better than was anticipated.
>
> In Darfur, the chief breeding centre, with the exception of the Rezeigat tribe whose young stock had suffered considerably, the results were surprisingly good, particularly so in Dar Beni Helba and Nyala Districts where large numbers of well-grown, young, half and three-quarter breds were seen.
>
> In Kordofan conditions were generally disappointing. Of the many foals, yearlings and two-year-olds seen last year only very few have survived and the majority of these were showing every sign of emaciation and retarded growth due to insufficient nourishment; disease had taken very heavy toll of the young stock already weakened by starvation. Both the Messeria and Humr experienced a very hard time from

April to September; the former tribe, although once horse owners of repute and our main remount supply up to 1918, seem now only able to produce a few horses up to the Sudan Defence Force and Police standard. This tribe only half-heartedly adopted the Breeding Scheme and, up to a few years ago, their stock was rapidly deteriorating both in quality and numbers. This backward drift was checked in 1928 when they made real attempts to make up lost ground but, taking into consideration the abnormal losses during the past year through no fault of their own, their efforts have not been attended with any conspicuous success.

The results observed in the Humr, their southern neighbours, who were lucky in having a moderately good grain crop and had time to get a little condition on their horses for the Show, were more satisfactory. As a tribe they have shown great keenness and it is to be regretted that owing to local conditions and the inferiority and small size of their stock, they are not likely to be in a position to produce marketable horses in numbers unless we supply indigenous sires whose offspring is suited to and can withstand the conditions under which the nomad Baggara horse has to live and work. The keeping of a few Arab Stallions at Muglad has been of undoubted political value, but, although several half-bred horses are thriving in the possession of a few affluent men, the foreign half and three-quarter-bred is unlikely to survive to maturity and, unless he is sold out of the tribe when quite young, there is little use in attempting to breed him.

As far as Kordofan and Darfur are concerned, there is no doubt whatever that, from a horse production point of view, to improve the local stock by the introduction of foreign blood we must concentrate on and devote our efforts to the tribes occupying the Districts of Kalaka to Dar Taaisha and from North of the River to Parallel 13, with Nyala as headquarters. The fact that the cross-bred horses have withstood the past year of drought and starvation is very encouraging.. The improved stock seen was excellent, the half and three-quarter-bred Arab has been definitely established and is now in such numbers as to be safe. This is not so with the progeny of thorough-breds which must have special care and attention, and good results in numbers are not likely to be produced in the out-districts where the majority of the owners cannot afford to give special diet, especially in a year of drought and famine. I may state that of the one hundred and sixty-three horses purchased for the Army and officials, thirty-three were by imported Arab horses and twenty by Sudan Country-Bred stallions.

Many of the Darfur tribes are not only keeping up the numbers of their stock but are improving the average quality by eliminating misshapen animals. The owners now know what type and standard is saleable. The reasons for rejecting a horse are always explained to the owner and the Baggara realises only too well that the difference in price between acceptable and rejected animals is at the present time, in terms of cattle, approximately five to seven heifers.

The Northern Area. (Khartoum, Wad Medani and Shendi) :- With the exception of the towns, where horses are produced under artificial conditions, the area has suffered very severely. From reports received at various times during the year it appears that not only foals and yearlings but adult animals have died in numbers of starvation.

The Khartoum and Wad Medani race courses and polo grounds testify to what has been produced - first class half and three-quarter-bred Arabs and thorough-breds with size and quality are to be seen in numbers - and it is safe to say that an improved Sudan Country-bred has been evolved, comparing favourably with the Syrian, Arab and Barb, which, in the near future, will replace the imported horse.

The usual Horse Shows were held in Kordofan, Darfur and Shendi.

The Gezira Staff of the Sudan Plantations Syndicate and some of the tenants have bred many good horses.

The Officers of the Cavalry and Mounted Rifles at Shendi have done much in the District to foster horse-breeding and to encourage the native owners.

The continued keenness and interest shown by Darfur Officials and Officers & the S.D.F. are much appreciated by the tribal owners.

The horse breeding scheme can definitely be said to have progressed and, having successfully survived this year, the future prospects are bright.

The following list shows the distribution of Government stallions as at the end of the year :-

Darfur Province :- No Joke (English thoroughbred); Diamond Jubilee (Egyptian country-bred); Kiclan, Allahom, Talab, Monarch, Assad El Kerim, Escort, Rafdan, El Nazir, El Sheikh, Nasr El Din, El Butt, Tigre Royal, Prince John, El Barg, Gambeil, Omda, Pintail, Kassab and Wayel (Arabs); Ziada and Master Wimpole (Sudan country-breds).

Kordofan Province :- Farad, Irrigation, Mutamad, Murgan, Ein-el-Shams, Dinar, Economy and Kalamity (Arabs); Messerie and Onbashi (Sudan country-breds).

Khartoum and Shendi :- Viaduct and Oberto (English thorough-breds); Melik, Sapper and Faisir (Arabs).

Casualties during the year were :-

One English thoroughbred (Tom Bowling) cast in Khartoum.

Two Arabs (Fil-Fil and Cinders) died in Darfur.

One Sudan country-bred (Helbawi) died in Kordofan.

The English thoroughbreds Viaduct, No Joke and Oberto are all fit and in good condition, and have all had good crops of foals.

The produce of our best Arab horses is excellent throughout the breeding areas. It should only be necessary to import a few high class Arab sires from time to time to keep up the standard."

Camels.

As in previous years the military authorities kindly agreed to hand over to this Service any well-bred Bisharin camels, suitable for breeding purposes, which were cast from the Camel Corps during the year. Five camels were selected under this arrangement and were issued to responsible Camel breeders in Northern Kordofan. These gifts were much appreciated.

Mule Breeding.

The results of the hinny-breeding experiment which was started two years ago at Nyala, Southern Darfur, have not been at all encouraging and it has been decided to discontinue it. The difficulties to be overcome before hinny-breeding could be carried out successfully by the natives themselves are now realised to be so great as to render any scheme of this nature impracticable under existing conditions.

It is suggested that mule breeding might be tried as an alternative but, owing to financial stringency, there is little likelihood that funds for further experiments of this nature will be forthcoming in the near future.

Poultry.

Birds of the following breeds were imported by private individuals during the year :- White Leghorn, White Wyandotte, Rhode Island Red and Light Sussex. A pen of Khaki Campbell Ducks was also imported.

The results of the distribution of fowls of improved breeds are becoming very evident in the Provinces, particularly in Darfur, Kordofan and Kassala where cross-bred fowls may be seen in numbers. Mr. Grabham distributed one hundred and twenty chicks and, in addition to large numbers of eggs distributed in Kordofan Province by other poultry enthusiasts, Captain Williams, the Veterinary Inspector of that Province, distributed sixty-three cockerels and 1,500 eggs during the year, all free of charge. Mention must also be made of the praiseworthy efforts of Major Titherington to improve the breed of poultry in the Upper Nile Province.

SECTION IV.

MISCELLANEOUS.

GRAZING AND WATER.

To add to the troubles of owners of livestock, light rains in the previous year and the depredations of locusts resulted in grazing being scarce throughout Central Sudan from the beginning of the year until the onset of the rains. As the dry season progressed, the position in certain areas became extremely grave. Many cattle were reported to have died of starvation in July and, when the rains broke, a heavy mortality occurred amongst sheep, particularly among ewes on the point of lambing.

Generally speaking the rains were late but good and, in September, grazing was reported to be abundant in the northern areas. Conditions are not so satisfactory in the South, however, and it is feared that another bad season will be experienced there next year.

A serious reduction in the milk supply was reported in many of the cattle breeding areas. This was attributable partly to the scarcity of food but mainly to the effects of cattle plague, since many of the cows which recovered from this disease aborted afterwards.

LIVESTOCK SHOWS.

The Gezira Livestock Show was not held this year owing to the depression affecting the cotton industry. This was unfortunate in many ways as the Show had come to be regarded as an annual event and the native tenant farmers displayed a lively interest in all classes of animals exhibited.

A very successful horse show was held at Shendi in March, its success being largely due to the keen interest taken in it by the Officer Commanding and the Officers of the Cavalry and Mounted Rifles.

BELGRAVIA DAIRY.

The quantities of dairy produce sold from the Government Dairy at Khartoum North during the year were as follows :-

Fresh milk 11,693 gallons, fresh cream 207 gallons and fresh butter 2,116 lbs. These figures show decreases of 744 gallons, 47 gallons and 692 lbs., respectively, when compared with last year.

VETERINARY HOSPITALS.

The number of animals which received treatment at the Veterinary Hospitals in Khartoum and Wad Medani during the year were as follows :-

Khartoum..	.....	4676
Wad Medani	.....	4439

The returns of the shoeing forge attached to the Khartoum Veterinary Hospital show that 2,842 horses and mules were shod as compared with 4,352 last year and 4,731 in 1929.

ACKNOWLEDGEMENTS.

The period under review has been a most trying one from a veterinary point of view and, in concluding this resume of the year's work, I would take the opportunity to mention the good work that has been carried out by all members of my staff during the year and to thank them for the loyal support which they never failed to give me.

I also wish to record my appreciation of the assistance which has been so freely given to me and my staff by all other Departments and Services when called upon.

(Sgd.) W. Kennedy
DIRECTOR, SUDAN VETERINARY SERVICE.

(21)

APPENDIX II.

ANNUAL REPORT
OF THE
VETERINARY RESEARCH OFFICER,
SUDAN GOVERNMENT,
1931.

A. STAFF.

The classified staff throughout the year has consisted of myself, one Assistant Veterinary Research Officer, one Laboratory Assistant and one Sudanese clerk.

A Veterinary Inspector (Mr.A.B. MacIntyre) was attached to the laboratory during the first three months of the year, and was during that period in charge of the serum laboratory at Malakal. On April 1st., the Assistant Veterinary Research Officer (Mr. J.T.R. Evans, B.Sc.) assumed charge of the Malakal laboratory and Mr. MacIntyre reverted to the field staff.

I travelled to Malakal towards the end of March in order to inspect the serum laboratory and confer with the Governor, and returned to Khartoum in mid-April.

The Assistant Veterinary Research Officer returned to Khartoum in early July, at the conclusion of the serum making season, and was in charge of the Khartoum laboratory during my leave, from mid-July to mid-October, At the end of October he again proceeded to Malakal for the 1931-32 working season. He has now been posted to Malakal as his permanent station.

B. ROUTINE WORK

The main sections of routine work have been, the manufacture of cattle plague antiserum, the preparation and issue of contagious bovine pleuro-pneumonia vaccine, the issue of materials for the diagnosis and control of camel trypanosomiasis and examining and reporting on specimens submitted for diagnosis.

I. EXAMINATION OF SPECIMENS.

A total of 463 specimens has been examined, this number being exclusive of examinations made in connection with research work or ordinary routine within the laboratory, and of specimens that have been forwarded to other Departments for special examination. The following is a list of diagnoses set out under headings of animal species :-

HORSES.

Epizootic lymphangitis	36	
Common pyogenic infections	14	
Trypanosoma congolense	2	
Trypanosoma brucei	1	
Cutaneous habronemiasis	1	
Filariasis (in blood)	1	
Gastrodiscus aegyptiacus	1	
Negative	89	145

MULES.

Epizootic lymphangitis	41	
Common pyogenic infections	9	
Trypanosoma brucei	2	
Cutaneous habronemiasis	2	
Negative	32	86

DONKEYS.

Epizootic lymphangitis	4	
Common pyogenic infections	3	
Trypanosoma congolense	1	
Sarcoma	1	
Negative	15	24

CAMELS.

Trypanosoma soudanense	18	
Filariasis (in blood)	2	
Anthrax	1	
Negative	56	77

CATTLE

Theileriasis (Theileria ? sp.)	2	
Theileria & Piroplasma bigeminum	1	
Piroplasma bigeminum	1	
Trypanosoma congolense	1	
Coccidiosis	2	
Actinomycos	1	
Negative	31	39

DOGS.

Common pyogenic infections	2	
Negative	36	38

FOWLS.

Spirochaetosis	3	
Negative	23	26

GAZELLE (?sp)

Streptococcic pneumonia	1	1

ROAN ANTELOPE.

Cysticercus tenuicollis	1	1

MISCELLANEOUS NEGATIVE.

Giraffe (4), Gazelle (1), Buffalo (1) Hartebeest (1), Kudu (1), Sheep (1), Parrot (2), Duck (6), Goose (1), Turkey (8)	26	26
TOTAL......................		463

II. NOTES ON SPECIMENS EXAMINED

(i) Epizootic lymphangitis.

This disease has provided the largest number of positive diagnoses and has included more interesting specimens than any other condition.

Included in the foregoing list are the following:-

(a) Cryptococci found in a lung lesion of a horse which had earlier shown moderately accute symptoms of pneumonia and had thereafter not recovered condition. External lesions were absent.

(b) Cryptococci in the lung of a mule showing obscure respiratory symptoms, post-mortem examination revealing considerable diffuse solidification of the lungs.

(c) A generalised case of epizootic lymphangitis in a horse owned by a native.

The first two of these cases, from Kassala and Fung respectively cannot now be considered very noteworthy, since a pulmonary form of cryptococcus infection has recently been demonstrated and described in some detail. The third case, however, is worthy of note in that generalised epizootic lymphangitis is rarely encountered. The case was particularly brought to the notice of the laboratory on account of its resemblance to glanders, although the latter disease has not yet been seen in this country. The suspicious features were the presence of multiple open cutaneous lesions without great thickening of lymphatic vessels, a glue-like yellowish nasal discharge, and the discovery of a number of small hard nodules in the lungs on post-mortem examination. In the laboratory, smears from various sites were found to be swarming with cryptococci in almost pure culture, but the greatest interest lay in the contents of the lung nodules; these, although containing considerable numbers of typical cryptococci, were also very rich in mycelial elements such as have hitherto only been described in cultures of the organism in artificial culture media.

In addition to the above mentioned proved cases, there have been two lung specimens, one each from a horse and a mule that showed histological changes suggestive of early cryptococcus infection. Failing the demonstration of the actual organism, however, these specimens have not been reported as cases of cryptococcus infection.

In regard to the topographical distribution of the disease, the following table provides a summary :-

TABLE I.

Positive diagnoses of epizootic lymphangitis classified by provinces and animal species.

Province	Horses	Mules	Donkeys	Total
Upper Nile	19	29	2	50
The Fung	-	9 *	2	11
Kordofan	7	3	-	10
Blue Nile	4 *	-	-	4
Darfur	3	-	-	3
Berber	1	-	-	1
White Nile	1	-	-	1
Kassala	1 *	-	-	1
TOTAL...	36	41	4	81

* includes cases (a), (b) and (c) just described.

(ii) Trypanosomiasis.

The number of cases of camel trypanosomiasis diagnosed bears no relation to the number of cases that have occurred, since nearly all diagnosis is now carried out by Veterinary Inspectors, using the mercuric chloride test.

In regard to other species, the two cases of T. congolense infection were from one horse, taken at different times, in Gambeila; the T. brucei case was from another horse in Gambeila. The two T. brucei cases in mules were from Nasser, while the one T. congolense case in a cow was also from the Upper Nile Province (Fathai). The single T. congolense case in a donkey was from Kordofan (Delami).

(iii) Anthrax.

The single case was in a camel at Kassala. Seeing that anthrax is relatively rarely diagnosed in the Sudan, it is interesting to note that two cases occurred in Kassala last year.

III. CONTROL OF CAMEL TRYPANOSOMIASIS

The method of control throughout the year has been substantially the same as that instituted in 1930, namely, diagnosis in the field by means of the mercuric chloride test and treatment of positive reactors with Naganol. Towards the end of the year, however, two modifications were introduced into routine practice, one in regard to diagnosis and one in regard to treatment. The technique of applying the mercuric chloride test has been modified by finally adopting a 1-25,000 dilution of the salt, and reading the result immediately after setting up the test instead of waiting for a quarter of an hour. This decision has been arrived at as the result of a year's co-operation between the laboratory and the field staff. Regarding treatment, the routine administration of a single dose of only four grammes of Naganol, instead of ten grammes as in earlier years, has been adopted. This dosage may not be the one finally chosen, but it is being universally used at present as the result of, and in continuation of, experiments carried out by certain Veterinary Inspectors in collaboration with the laboratory.

Details of the evidence leading up to the two above mentioned modifications are set out in the later section of this Report dealing with research.

IV. CATTLE PLAGUE.

The production of cattle plague antiserum has been the largest of the routine duties of the laboratory, the whole of the year's output having been prepared at Malakal.

Fortunately the permanent buildings necessary for work in accordance with the year's programme were almost completed at the beginning of the year, and it was possible to occupy them before starting the season's work.

The supply of cattle was also more satisfactory than in earlier years. All large cattle, destined to supply the serum, had been collected, immunised, and held in reserve from the foregoing season, while the supply of young susceptible cattle for the maintenance of virus was adequate throughout, although on occasion the stock in hand became so small as to cause anxiety. The adequate cattle supply calls for especial note, since serum production is a new service

to the Sudan, and the rate of production has continued to increase yearly, although it has not yet been possible to work out suitable arrangements for acquiring and storing cattle. During the season under review, moreover, cattle plague raged with an intensity hitherto unknown in this country, causing severe losses even in the districts to which one looked for current supplies of young susceptible cattle. The ultimate adequacy of the cattle supply, not only as regards numbers but also in point of suitability, without the occurrence of any serious check, is attributable to the fullest co-operation of the Upper Nile Province staff and the local Veterinary Inspector with the laboratory.

Grazing throughout the season was extremely bad, as a result of the very light rains in 1930. Although every help was afforded by the Governor, the serum producing cattle became very emaciated towards the end of the season, owing to the almost complete absence of grass at any reasonable distance from the laboratory. Later in the year, in view of the increased requirements of serum for 1932 and subsequent years, the Governor allotted a further area of grazing land. In normal seasons grazing should be ample, but in 1931 again the rains in the Upper Nile have been light. Serum production for 1932 has therefore already been started, and it is hoped that the work may be relatively advanced before the shortage of grass has affected the cattle too severely.

In regard to the serum itself, the total output aimed at in the 1931 season was 3,000 litres, or 60,000 nominal "doses" of 50 c.c. Ultimately 3,650 litres, or 73,000 nominal "doses", were prepared. The normal method of issue, whereby, before bottling, a large mixed sample is made and submitted to potency titration, could not be carried out. The occurrence of cattle plague on an unprecedented scale throughout the Sudan was accompanied by the most urgent demands for serum, and the latter had to be issued bleeding by bleeding as soon as it was prepared. In the earlier stages this method of issue was not attended by any ill results, as all lots issued proved under field conditions to be of sufficient potency. Later, however, when the serum producing cattle were becoming weakened by starvation, variations in potency became evident, in that while most issues of serum were effective occasional samples were not, the latter failing to protect injected cattle against the disease - in fact, in consideration of the policy of mixing serumised with infected cattle, the course of some outbreaks was necessarily accelerated. Although such accidents were unfortunately and sometimes gave rise to local dissatisfaction, they could not have been avoided except by delaying the issue of serum, a procedure that would have entailed the loss of many thousands more cattle than actually succumbed.

A potentially serious feature in three of the instances in which the serum failed to protect was that the herds involved were in the Upper Nile Province, in which serum had never been used before. It was feared that this introduction to serumisation might destroy the confidence of the natives. Reports from the Veterinary Inspector of that Province, and in particular his annual report which views the situation in retrospect, show that this has not occurred. Localised distrust developed, but the satisfactory results in general made it short lived.

It has been stated that no potency titration of a mixed bulk sample of serum was carried out. This statement applies to the greater part of the season, when no mixed sample was issued, and consequently there seemed to be no point in titrating one, the more especially as all available cattle were required for making serum, and in any case the serum was being submitted to the most severe of all tests in the field and was proving sufficiently potent. Towards the end of the season, however, cattle plague became less general and a small mixed stock of serum from the latest bleedings was built up. This was subsequently tested and found to be of low potency; while all bulk samples tested in the preceding four years, during which serum has been made in the Sudan, had been found protective at dosages of not more than 10 c.c. per 100 lb. body weight, the late 1931 sample was not certainly protective at less than double this dose. The low potency of serum from the later bleedings is presumably to be ascribed to the extreme emaciation of the serum producing cattle. In addition to low potency the serum from later bleedings was below standard in keeping qualities, in that on storage for ~~for~~ a few months an abnormally heavy deposit sedimented out. No effort was made to analyse this deposit, but its appearance was provisionally ascribed to the same source as the low potency, namely, poor condition of the serum producing cattle.

The new laboratory attendants, who were engaged following approval for increase of subordinate staff, did not in general prove up to the required standard, although men were specially chosen from retrenched veterinary police; four out of six had to be dismissed in April, and were not replaced until the end of the year. Local unskilled labour was plentiful throughout the season.

In general, the situation in regard to cattle plague antiserum production is satisfactory; the buildings of the Malakal laboratory are completed, the subordinate staff is being selected and trained, and in regard to cattle supply, in spite of no finality having been reached on the best method of collection and storage, the willing co-operation of the Upper Nile Province staff at least ensures that the supply will not fail. The quality of rains, and therefore of grazing, must always be a matter of doubt, but it is hardly possible that grazing can be worse than in the past year. It is therefore hoped that during the coming season an appreciable reserve of serum will be accumulated.

V. CONTAGIOUS BOVINE PLEURO-PNEUMONIA.

A total of 23,580 doses of vaccine has been issued to the field. The policy throughout the year has been to issue living culture virus of a "moderate" number of generations in subculture, pending opportunity for further studies on attenuation. Actually nearly all issues were of cultures between the 30th. and 60th. generations, and in regard to safety it is to be noted that no complaint has been received.

It is further interesting to note that the amount of vaccine requisitioned was greatly in advance of the 1930 demands. In that year the annually increasing rate of demand dropped (to 15,000 odd as compared with 28,000 odd in 1929) on account of the greater urgency of dealing with cattle plague. This year, however, in spite of the far more widespread occurrence of cattle plague, demands for contagious pleuro-pneumonia vaccine have increased by over fifty per cent. as compared with last year.

C. RESEARCH.

The opportunities for deliberate research during the past year have been somewhat limited. Work has, however, been carried out on camel trypanosomiasis, cattle plague and epizootic lymphangitis. The following is a summary of observations in as far as they have reached a stage worthy of report.

I. CAMEL TRYPANOSOMIASIS.

Two main items of work were undertaken, namely, observations on the possibility of reducing the routine dose of Naganol and a final assessment of the technique of the mercuric chloride test for diagnosis. Both of these entailed close co-operation with the field veterinary staff. In addition, some preliminary work was carried out in the laboratory on the possibility of carrying out the mercuric chloride test with dried samples of serum.

1. Dose of Naganol.

The standard routine dose of Naganol that has been used during the past five years has been ten grammes in watery solution intravenously. As has already been mentioned in earlier Reports, this dose is probably larger than the minimum necessary, but it has been provisionally retained because it has at least the virtue of combining absolute curative properties as a single dose with complete safety.

The certainty of cure has been necessary for the large scale confirmation in the field of laboratory experiments carried out in 1928 on the duration of "immunity" following cure; to have employed a dose of the curative value of which there was any doubt would have led to the confusion of relapses with re-infections. Ample confirmation of laboratory results (see this Report 1928, p.41) has now been obtained and it has become practicable to consider the reduction of the dose of Naganol.

Few references are to be found in the literature regarding the smallest effective dose of Naganol, but it seems that three grammes has been found insufficient. A dose of four grammes is used in India, but on this procedure a very short note only has been made by Williams, (Journal of the R.A.V.C., 1930, Vol. 1, p.240) consisting merely of the statement that all camels reacting positively to the mercuric chloride test are treated immediately with four grammes of Naganol; no further details are provided. It seemed, however, that four grammes would be a good standard to which to work in one's own experiments.

In order to obatin results on a large scale in a short time it was necessary to allot the experiments to the field staff of the Veterinary Service, since to have conducted them in the laboratory would have entailed either too great a delay or too great an expense.

The scheme adopted was for one Veterinary Inspector to study the efficacy of a single four gramme dose, and another independently to carry out exactly parallel experiments with a seven gramme dose, the latter, intermediate between the original and the projected doses, being regarded as a reserve, in case the four gramme dose should not prove universally effective. The technique consisted in each case of treating fifty infected camels, selected either by a microscopic diagnosis of trypanosomiasis or by a strong positive reaction to the mercuric chloride test. Further observations consisted in monthly tests by the mercuric chloride test, combined whenever possible with microscopic examination of the blood, and in any case supported by clinical notes. Observations were summarised on special forms and later studied in the laboratory. It is to be noted that in this scheme great reliance had to be placed on the mercuric chloride test, and that this test was being provisionally carried out using a 1-20,000 dilution of the salt. It has already been stated that this solution might be of such strength that a few normal - i.e. cured or hitherto uninfected - camels might give positive reactions. Thus, complete disappearance of the reaction in some cured camels might not occur, even after an interval of some months. It was, however, considered that a progressive weakening of a previously strong reaction, accompanied by constantly negative microscopical findings and sustained improvement in condition, would be sufficient evidence of cure.

The work was commenced towards the end of 1930 and observations continued up to the middle of 1931, the treatment with seven grammes having been carried out in Kassala Province by Captain J. Going and that with four grammes in Kordofan by Captain H.B. Williams, O.B.E. and Mr. J.A. Gillespie.

The results, considered in general, were unequivocally clear cut; there is no doubt that every camel treated, whether with seven or with four grammes, was cured. It is not necessary in this summary to discuss the supporting protocols at length, as it is hoped to set these out later in a full publication. Meanwhile, however, it is necessary to acknowledge the care and interest taken by the three co-operating Veterinary Inspectors, especially as their detailed records will allow much more information to be extracted.

As the result of these observations it has now been decided to treat all trypanosome infected camels with four grammes of Naganol for at least a year and to collect further information.

2. Technique of the mercuric chloride test.

The principle of this test has already been sufficiently described. Throughout the past year, however, during which it has been generally used, attempts have been made to standardise the technique still further, and to ensure that in general field practice it will give as good results as have been obtained in the laboratory. The main point at issue has been the decision as to whether a stronger solution of mercuric chloride than 1-25,000 can be used. It has already been shown (*Jl. Comp. Path. and Therap.*, 1929, Vol. 42, p.118) that in order to get clear cut results in all cases it is not permissible to use a solution stronger than 1-25,000, although the number of doubtful reactions with a 1-20,000 solution are relatively few - in the laboratory at any rate. It has also been shown (this Report, 1928, p.39), as would *a priori* have been supposed, that in infected camels a positive reaction develops within a shorter interval after infection to the 1-20,000 than to the 1-25,000 dilution. For practical purposes, therefore, it had to be ascertained whether the earlier detection of most field cases with the stronger solution would outweigh the disadvantage of diagnosing the disease in a number of uninfected camels. In order to eliminate possible variations in the purity of the salt itself all solutions used throughout the observations were prepared in the laboratory with "A.R." standard mercuric chloride (British Drug Houses Ltd.).

General field use of the test for a year has shown that the employment of a 1-20,000 solution is not justified. In field practice the disadvantage is not confined to the making of a few faulty original positive diagnoses in clean camels; later tests of these camels will also show faintly positive reactions, and in addition, strongly

reacting and undoubtedly infected camels will in some cases not revert after cure to a completely negative reaction, or in other cases may take so long to do so that the period is greater than the duration of "immunity", thus possibly leading to the confusion of relapses and re-infections. The use of "A.R." standard mercuric chloride, as distinguished from druggists' samples of "pure" mercuric chloride, serves to increase the number of border-line reactions in healthy camels if a 1-20,000 solution is employed. In fact, the doubt that existed, as to what strength of solution to use, has been removed; a 1-25,000 dilution of "A.R." mercuric chloride is the strongest permissible as a routine.

The reading of the result of the test almost immediately after mixing the serum with the solution, although only a very minor modification of technique, is also useful in eliminating doubtful results. It is admitted that in a positive reaction the opacity becomes progressively denser up to a period of about fifteen minutes. Unfortunately, however, unless the serum to be tested is absolutely free from corpuscles - and under field conditions many samples are not - there is a tendency for a faint pseudo-reaction to develop within ten or fifteen minutes in the case of some normal camels, even with a 1-25,000 dilution of mercuric chloride. Such cases are few but, as a truly positive reaction begins to develop immediately the test is set up, they can be eliminated by reading the result within a minute or so.

In order that the foregoing modifications may be viewed in proper proportion, it may be pointed out that they have been introduced solely in order to deal with a relatively very small number of camels. In most instances, where there is any suspicion of trypanosomiasis in a camel on clinical grounds, a positive reaction in the case of an infected individual is so definite as to be unmistakeable; in the periodical routine testing of camel units, however, when no particular individuals are under consideration, and in which some camels may have been treated some months earlier, the drawing of a rigid line is necessary. Pending a more detailed publication of the observations leading to the above mentioned modifications in technique it is necessary to acknowledge the co-operation of Captain J. Going of this Service in recording some hundreds of tests carried out under field conditions.

3. Tests with dried serum.

The common practice of storing type samples of antitoxic and other sera in the dry state, in which they seem to undergo little alteration, suggested that the same thing might be possible in the case of serum samples from camels suspected to be suffering from trypanosomiasis. The practical applications of the possibility are perhaps limited under Sudan conditions, but there are undoubtedly circumstances in which use could be made of it elsewhere.

Experiments in this laboratory have shown that the positively reacting serum of infected camels can be dried on filter paper and will retain its titre for several months; conversely, negatively reacting serum remains negative. Technique has not been exhaustively studied, but the following are some necessary precautions :-

(1) The filter paper used must be of good quality and fairly hard, otherwise disintegration of the paper will obscure the reading of the subsequent test.

(ii) In absorbing the serum the best method hitherto tried has been to drop single drops on to the paper at sufficient intervals to avoid coalescence. For subsequent tests single drops can be cut out.

(iii) In carrying out a test the drop and its paper should be cut into small pieces and soaked for at least half an hour in half a cubic centimetre of distilled water. The pieces may then either be left or removed, and half a cubic centimetre of double the test strength of mercuric chloride solution added.

In reading the results it has been noted that with positive serum that has been stored on dry filter paper for some months a progressively longer interval is necessary for the reaction to develop, but in the case of even fairly fresh negative serum no opacity develops after an interval of several hours. In regard to the third precaution noted above, the necessity for soaking the serum and paper in water is that if the paper is placed directly into the mercuric chloride solution many positive samples will fail to give a preceipitate. It is provisionally assumed that such irregular results depend on the degree to which the serum, while still liquid, has penetrated the substance or dried on the surface of the paper; sera which have been well absorbed into the paper presumably give the precipitate but it remains in the substance of the paper.

It is not intended for the present to proceed further with this form of test, but its practicability is at least worthy of note.

Towards the end of the year experiments were instituted with a view of determining the protective power of Naganol in clean camels in the face of subsequent trypanosome infection. These experiments are necessary in order to clear up a certain misconception that apparently exists in regard to our present system of trypanosome control. It sometimes happens that, in the absence of a Veterinary Inspector, a camel is given a dose of Naganol

because it is in poor condition, the existence of trypanosomiasis being assumed in the absence of either microscopic examination of the blood or application of the mercuric chloride test. Such a camel may not improve in condition or may even shortly afterwards be found to have trypansomiasis, and doubt is thrown on the efficacy of the treatment. Apart from such considerations, however, the period over which Naganol can protect clean camels against infection is a point worth determining. The experiments were instituted late in the year and no results are yet available.

II. CATTLE PLAGUE

Two lines of work were undertaken, but the general cattle plague situation made it impossible to proceed very far with them.

In the Khartoum laboratory the main objective was to investigate the possibility of producing a vaccine with keeping qualities superior to those of the cattle plague vaccines receiving attention in other countries. The desirability of such a vaccine is evident in consideration of the local circumstances, wherein serum production is not in progress throughout the year, and consequently there is a considerable break in the availability of material for making the vaccine. Moreover, a vaccine of good keeping qualities is necessary in any circumstances if a reserve stock is to be built up.

Preliminary experiments on a small laboratory scale had already indicated that a vaccine capable of retaining its antigenic qualities for some months could be made on a large scale, and it was intended to prepare a large issue for testing under field conditions. The extreme urgency of the general situation, however, made it necessary, as was the case with serum, to use it as soon as it was prepared. There was no doubt as to the antigenic value of such a vaccine in the fresh state, but in the circumstances in which one was forced to use it no useful information beyond this point could be obtained.

Seeing, however, that this constitutes the first occasion on which a cattle plague vaccine has been used under field conditions in the Sudan it is desirable to make a brief note of the results. In consideration of the essential nature of any vaccine, the results were excellent. The only complaint received was from Bor district, in which vaccination was carried out at a time when cattle plague was rapidly approaching. Considerable dissatisfaction was shortly afterwards expressed at the subsequent death of about 40 vaccinated cattle. The following quotation from the annual report of the local Veterinary Inspector, however, describes the situation as viewed in retrospect :-

"Cattle plague vaccine was used for the "inoculation of 5,248 cattle, and apparently with "excellent results. In Bor District 1,754 cattle were "vaccinated; later these animals were exposed to cattle "plague infection but it is reported that the mortality "of the vaccinated cattle was only 2.2% while unvaccinated "cattle died in large numbers." And of another herd :- "In another instance 161 cattle were vaccinated and came "into contact with infected cattle 14 days after; the "mortality of the vaccinated cattle was reported as 1.2%." These results were obtained in a region in which the mortality rate in naturally infected cattle during the same season exceeded 80%.

The laboratory was robbed of its experiment, but the saving of some thousands of cattle which would otherwise have died can be considered sufficient compensation.

In the Malakal laboratory, which was functioning for the first time in permanent buildings, and with for the greater part a newly recruited staff, a small programme was drawn up for the production and testing of serum prepared with various modifications of the existing technique. Here again, owing to local conditions and the urgent demands for a maximum output of serum for field use, it was impossible to continue.

Towards the end of the year further experiments with similar objectives were started, but they have not yet reached a stage at which a report is warranted.

III. EPIZOOTIC LYMPHANGITIS.

The work recorded in last year's Report on the study of pulmonary cryptococcus infections was continued during the earlier months of this year. Ultimately a description of the condition was published in a scientific journal.

Experiments were also carried out, in continuation of some started in 1930, with the object of developing some kind of therapeutic treatment that could be applied to animals in outling stations where the visits of a Veterinary Inspector are infrequent. The very scattered distribution of positive cases has, however, made it impossible to proceed very far in this direction, since although a treatment capable of being administered by an intelligent native is the objective, the preliminary work must necessarily be carried out under the personal supervision of Veterinary Inspectors. The difficulty of working under experimental conditions and the expense of transport and maintenance do not allow of natural cases being sent to Khartoum. Work is at present proceeding in collaboration with Mr. Pembrey in the Fung Province and Mr. Glanville in the Upper Nile.

D. PUBLICATIONS

One paper only has been published from the laboratory during 1931 :-

BENNETT, S.C.J. Cryptococcus pneumonia in equidae. - Jl. Comp. Path. and Therap., 1931, Vol. 44, p.85-105.

E. SUMMARY

In general, the unprecedented scale on which cattle plague has raged throughout the country has directed the energies of the laboratory towards the preparation of the greatest possible quantity of serum. To this end the possession for the first time of permanent buildings at Malakal, and an adequate cattle supply, were in one's favour. Conversely, grazing conditions were almost incredibly bad and most of the newly recruited subordinate laboratory staff proved unsuitable. By abandoning most of the research programme on cattle plague, however, the amount of serum ultimately produced was over twenty per cent. more than originally planned. Most of this was of sufficient potency, but a portion produced towards the end of the season was of poor quality. The situation at the end of the year is that cattle plague is again under control and a small reserve of serum is in stock; this stock, however, is of low potency.

Cattle plague vaccine was used on a field scale for the first time in the Sudan. 5,000 odd doses were used in the Upper Nile Province and the results were excellent.

Demands for contagious bovine pleuro-pneumonia vaccine increased somewhat, in spite of the general preoccupation with cattle plague.

A certain amount of research was carried out in connection with camel trypanosomiasis in collaboration with the field staff, the main results being the confirmation of a short period of "immunity" in cured camels, and the finding that the routine dose of Naganol can be cut down by probably sixty per cent. Certain minor modifications were, as the result of collaboration with the field staff, introduced into the technique of the mercuric chloride test.

Research on cryptococcus pneumonia continued up to a point at which it was possible to publish a paper on the condition.

Later, researches that were earlier abandoned were re-instituted, and at the end of the year work was in progress on the technique of cattle plague antiserum production, cattle plague vaccine, the "prophylactic" value of Naganol in camel trypanosomiasis and the therapeutic treatment of epizootic lymphangitis.

The work of the small permanent laboratory staff needs acknowledgement; in consideration of its size the demands made on it have been heavy but, apart from the impossibility of keeping pace with requisitions for cattle plague antiserum in the early part of the year, all demands have been fulfilled. A great advance in the direction of general efficiency has been the appointment of a permanent Assistant Veterinary Research Officer to fill a vacancy of some four years' standing. The appointment was made late in 1930, but 1931 has been the first year in which the good results have been apparent. Although the filling of this vacancy has not improved the situation in regard to research it at least promises continuity in the most important routine duty of the laboratory, namely, the production of cattle plague antiserum.

In conclusion, the value to the Sudan Veterinary Service of close co-operation between the laboratory and field staffs has again been amply demonstrated. Without such co-operation, by the exercise of which experimental results can be verified in general field practice, the work of the laboratory would be largely sterile. During the past year, however, in spite of bad conditions generally, combined observations have produced results of considerable practical value.

(Sgd.) S.C.J. Bennett.

Khartoum,
20-1-1932.

VETERINARY RESEARCH OFFICER,
SUDAN GOVERNMENT.

Sadik.